DOCUMENT RESUME

ED 055 886 SE 012 573

TITLE	Recent Trends in Enrollment and Manpower Resources in Graduate Science Education, 1969-70.
INSTITUTION	National Science Foundation, Washington, D.C.
REPORT NO	NSF-71-14
PUB DATE	26 May 71
NOTE	4p.; Science Resources Studies Highlights
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*College Programs; *Doctoral Programs; Engineering; *Enrollment Trends; Graduate Professors; *Graduate Students; Higher Education; Mathematicians; *Scientific Manpower; Scientists

ABSTRACT

Based on information furnished by 227 doctorate-granting institutions in their applications for NSF traineeships, graduate enrollment in the sciences and engineering declined slightly between 1969 and 1970. The 1969-70 decrease and the declining trend in the rate of growth during 1967-69 contrast markedly with the nine percent annual rate of increase in enrollment for advanced degrees in the sciences and engineering that characterized the seven year period: 1960 to 1967. In contrast to the decline in graduate enrollment, the number of faculty and post doctorals increased during 1969-70, but at annual rates that were far below the comparable figures for 1967-69. The science doctorate departments covered in the present study accounted for more than 75 percent of the graduate enrollment and more than 90 percent of the doctorates granted in the sciences and engineering by U. S. universities and colleges. (Author/CP)

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NATIONAL SCIENCE FOUNDATION • WASHINGTON, D.C. 20550 • MAY 26, 1971 • NSF 71-14

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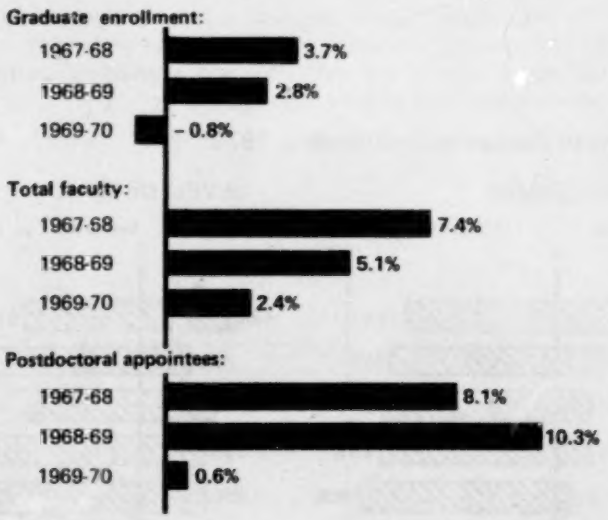
Recent Trends in Enrollment and Manpower Resources in Graduate Science Education, 1969-70

Graduate enrollment in the sciences and engineering declined slightly between 1969 and 1970, according to information furnished by 227 doctorate-granting institutions in their applications for NSF traineeships (chart 1). The 1969-70 decrease and the declining trend in the rate of growth during 1967-69 contrast markedly with the 9-percent annual rate of increase in enrollment for advanced degrees in the sciences and engineering that characterized the 7-year period 1960 to 1967.[1] In contrast to the decline in graduate enrollment, the number of faculty and postdoctorals increased during 1969-70, but at annual rates that were far below the comparable figures for 1967-69.

[1] Based on U.S. Office of Education statistics contained in National Science Foundation, *Trends in Graduate Education in Science and Engineering, 1960-69.* (In process.)

Chart 1. Annual rates of change in graduate enrollment, total faculty, and postdoctorals in doctorate science departments, 1967-70[a]



[a] The 1967-69 and 1968-69 percent changes were based on data submitted by 2,894 doctorate departments in the fall 1969; the 1969-70 percent change was based on data submitted by 2,740 doctorate departments in both 1969 and 1970.

SOURCE: National Science Foundation

Graduate Science Enrollment

The 1969-70 percent change in full- and part-time enrollment among areas of science behaved erratically (table 1). In absolute terms, the decline of part-time enrollment in engineering exceeded the increase in full time, while the decline in part-time students in the mathematical sciences offset the slight increase in full time. The situation differed in the social sciences which experienced a decline in the number of full-time students, but a slight increase in part-time students. Both full- and part-time enrollment in the life sciences and psychology increased, but enrollment in both categories decreased in the physical sciences.

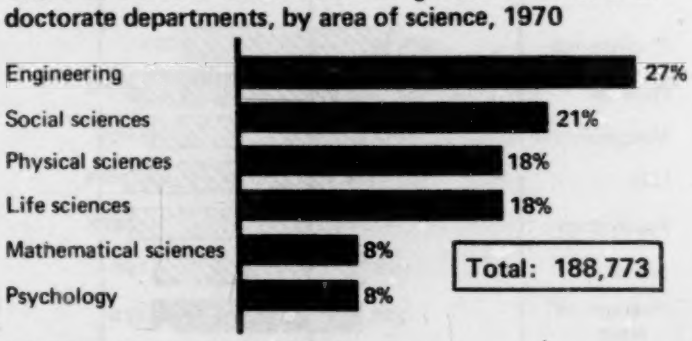
TABLE 1. *Percent change in graduate enrollment in doctorate departments, by area of science and enrollment status, 1969-70*[a]

Area of science	Total	Full time	Part time
Total	−0.8	0.1	−3.6
Engineering	−1.9	2.7	−8.4
Physical sciences	−3.2	−3.2	−3.3
Mathematical sciences	b	1.0	−3.2
Life sciences	1.7	.8	8.4
Psychology	1.8	1.5	3.7
Social sciences	−.3	−.9	2.0

[a] Data are based on 2,740 doctorate departments reporting in fall 1969 and 1970.

[b] Increase of less than 0.05 percent.

Chart 2. Percent distribution of graduate students in doctorate departments, by area of science, 1970



SOURCE: National Science Foundation

Prepared in the Universities and Nonprofit Institutions Studies Group, Office of Economic and Manpower Studies
Division of Science Resources and Policy Studies

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The percent distribution of graduate enrollment by area of science in 1970 is shown in chart 2. The rank order of areas of science was the same as that which prevailed during the 6 years that data have been collected from traineeship applications.

Of the 189,000 graduate students in doctorate departments, 77 percent were enrolled full time and 23 percent part time (chart 3).[2] The chart also classifies graduate enrollment in the various areas of science by citizenship and by level of study. Engineering led each of the other areas of science in the numbers of part-time, foreign, and first-year students.

The 4-percent decline in the number of part-time students was the principal characteristic of the overall enrollment drop in doctorate science departments from 1969 to 1970. However, there were several other important aspects of the slight increase in full-time enrollment during the period. For example, the number of U.S. citizen graduate students declined almost 1 percent while foreign graduate students increased 4 percent. Similarly, the number of first-year full-time students declined almost 3 percent while the beyond-first-year enrollment increased more than 1 percent.

The decline in first-year graduate enrollment from 1969 to 1970 is particularly important because of its effect on the future production of doctorates. Also of interest is the fact that institutions with high-rated graduate programs have reduced first-year enrollment in the sciences and engineering relatively more than other institutions. The leading institutions for which data are presented in table 2 were selected on the basis of information in *A Rating of Graduate Programs* by Roose and Anderson.[3] Although the findings of that report are controversial, the results are interesting and for that reason they are presented here. Table 2 shows that the 10 leading institutions in each discipline in terms of the rated quality of departmental graduate faculty averaged a 6-percent decline in first-year full-time enrollment in 17 selected fields compared with a decline of 3 percent in all other institutions. The 10 leading physics departments reported the greatest decrease—more than one-third fewer students in 1970 than in 1969. The remaining institutions also reported a decline in new physics enrollment, but to a lesser extent. The 10 institutions ranked highest in quality of graduate faculty also suffered sharp reductions in first-year enrollments in psychology, political science, chemistry, and geography.

Types and Sources of Major Support of Full-time Graduate Students [4]

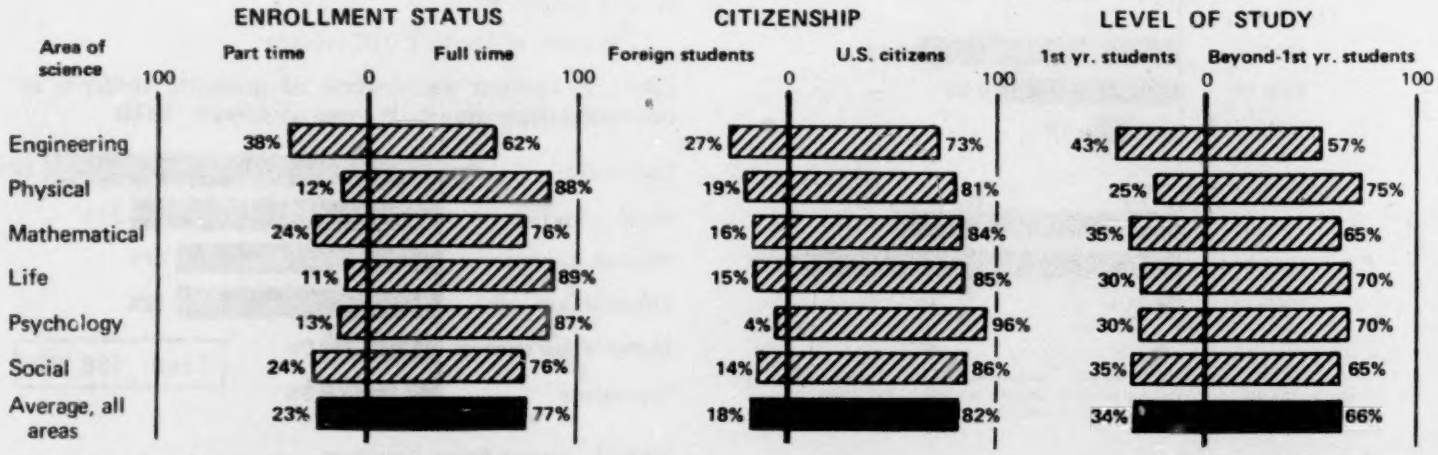
The types of support utilized by the 146,000 full-time graduate students enrolled in fall 1970 in doctorate science departments are summarized in chart 4. The rank order based on number of students utilizing such support is as follows: Fellowship-traineeships; "other" types of support—primarily self-support; teaching assistantships; and research assistantships. Within each of the areas of science, there was considerable variation in the relative importance of the various support mechanisms. For example, in the life sciences and psychology, stu-

[2]This report shows relatively more full-time and fewer part-time students than do the surveys of the U.S. Office of Education. The reason is differing NSF and OE definitions of full-time enrollment in graduate science departments. For a fuller description of these differences, see National Science Foundation, *Graduate Student Support and Manpower Resources in Graduate Science Education, Fall 1969* (NSF 70-40) (Washington, D.C. 20402: Superintendent of Documents, U.S. Government Printing Office), 1970, p.4.

[3]Kenneth D. Roose and Charles J. Anderson, *A Rating of Graduate Programs* (Washington, D.C. 20036: American Council on Education, 1970.)

[4]The term "major support" refers to a total stipend of $1,200 or more, excluding tuition. In cases of multiple support, the major source was reported, and a graduate student was counted only once under one category.

Chart 3. Characteristics of graduate students in doctorate departments, 1970



SOURCE: National Science Foundation

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TABLE 2. *Percent change in first-year full-time graduate enrollment in doctorate departments of 10 leading institutions,*[a] *compared with percent change in all other institutions in selected fields of science, 1969-70* [b]

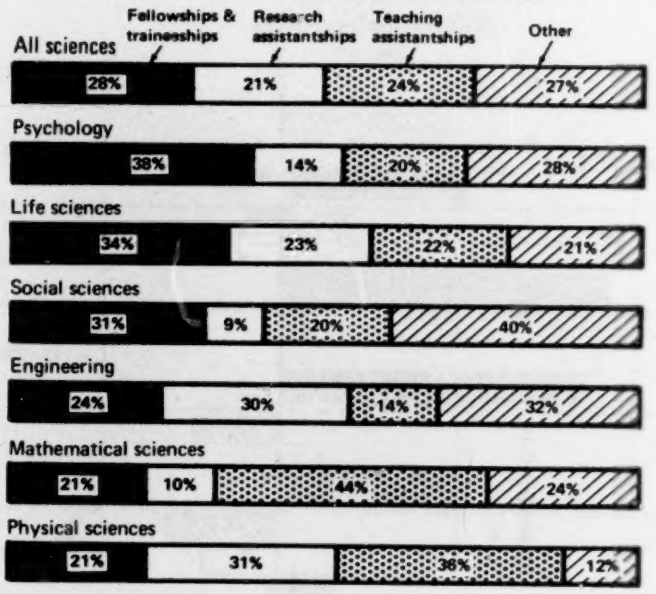
	Percent change, 1969-70	
	Ten leading institutions in each field[c]	All other institutions
Average, selected fields . .	−6.3	−2.6
Chemical engineering	13.2	1.5
Civil engineering	−2.3	10.9
Electrical engineering	10.3	−.8
Mechanical engineering	.7	12.7
Astronomy	1.4	−1.4
Chemistry	−14.1	−7.1
Geology	3.5	2.5
Physics	−33.8	−12.2
Mathematics	1.5	−5.5
Botany	−6.0	−2.6
Pharmacology	19.1	2.6
Psychology	−25.0	.4
Anthropology	4.0	5.2
Economics	−5.2	−3.4
Geography	−12.5	9.1
Political science	−19.8	−6.4
Sociology	−9.3	−12.1

[a]The 10 leading institutions in each of the selected fields of science or engineering were derived from rank order listings of leading departments, by rated quality of graduate faculty, published in the American Council on Education's volume (Kenneth D. Roose and Charles J. Anderson, authors), *A Rating of Graduate Programs* (Washington, D.C. 20036; American Council on Education, 1970). Enrollment statistics were supplied by doctorate departments that submitted applications for NSF traineeships in 1969 and 1970. Where traineeship applications were not submitted by one or more of the 10 leading departments, the group of 10 for each field of science was completed by selecting institutions with departments ranked 11th through 15th as necessary.

[b]Enrollment in all institutions in these selected departments represented 69 percent of total first-year full-time enrollment in all science and engineering fields in 1970. The 10 leading institutions accounted for 13 percent of total first-year full-time enrollment.

[c]It should be noted that the composition of the group of 10 institutions changes from field to field.

Chart 4. Percent distribution of types of major support of full-time graduate students in doctorate departments, by area of science, 1970



SOURCE: National Science Foundation

dents were primarily supported by fellowships and traineeships; in the physical and mathematical sciences, by teaching assistantships; and in engineering and the social sciences, by "other" mechanisms.

Four-fifths of all full-time graduate students enrolled in science doctorate departments depended on outside support in 1970. Those students relying upon support from institutions and State and local governments represented 37 percent of the total and used the teaching assistantship most frequently. Thirty-four percent of full-time graduate students were reported as receiving major support from the Federal Government, mostly through the fellowship-traineeship and research assistantship mechanisms.

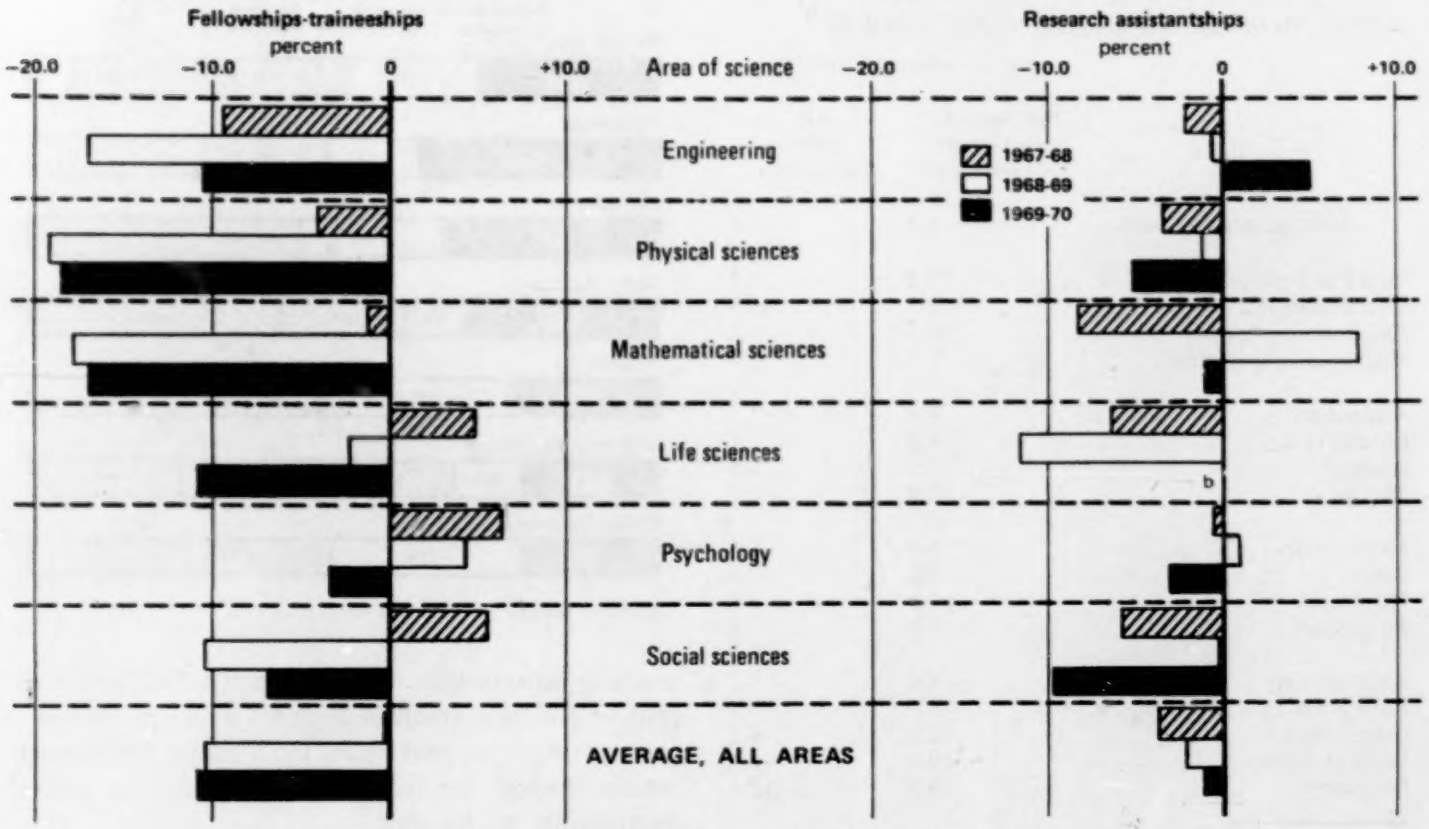
Fellowships-traineeships and research assistantships in 1970 provided financial assistance to 47,000 full-time graduate students in doctorate departments, or 93 percent of all students receiving Federal support. As can be seen in chart 5, annual percent changes in the number of graduate students financed through fellowships, traineeships and research assistantships for all areas of science combined, and for most individual areas of science, showed a rather consistent pattern of declining Federal support during 1967-70. The overall decrease in federally supported fellowships-traineeships was somewhat larger than the decline in research assistantships. From 1969 to 1970, the number of students supported through Federal fellowships-traineeships declined in each of the areas of science, while the number supported through Federal research assistantships dropped in all areas except engineering and the life sciences.

Number of Faculty and Postdoctoral Appointees

Full-time faculty totaled 58,000 in 1970, of which 85 percent were reported as graduate faculty significantly involved in teaching or directing the research of one or more graduate science students. More than one-fourth of the total faculty were involved in teaching or supervising research in the life sciences .

In the period 1969 to 1970, when full-time graduate enrollment increased only 0.1 percent, the number of

Chart 5. Percent change in the number of graduate students in doctorate departments supported by the U.S. Government through fellowships-traineeships and research assistantships, by area of science, 1967-68, 1968-69, and 1969-70[a]



[a]Based on data reported by matched departments that applied for NSF traineeships in each of the years 1967-70. These departments accounted for 81 percent of the fellowships-traineeships and 85 percent of the research assistantships that were financed by the U.S. Government in 1970.

[b]No change.

SOURCE: National Science Foundation

full-time faculty increased 2 percent in the departments reporting for both years. Every area of science reflected this rise to some extent, with psychology experiencing the greatest relative expansion, almost 6 percent, as shown below:

Area of science	Percent change, 1969-70		
	Full-time faculty	Post-doctoral appointees	Full-time graduate enrollment
Total	2.4	0.6	0.1
Engineering	2.2	.1	2.7
Physical sciences	1.5	−2.0	−3.2
Mathematical sciences	3.1	a	1.0
Life sciences	1.8	5.6	.8
Psychology	5.7	5.6	1.5
Social sciences	2.9	−20.3	−.9

[a]No change.

Postdoctoral appointments in 1970 numbered 8,900 with 83 percent in the physical and life sciences. Postdoctorals in the social sciences, representing less than 3 percent of the total, experienced a 20-percent decline during the period 1969-70, although enrollment suffered a loss of less than 1 percent and the number of faculty showed almost a 3-percent gain.

The statistics in this report for fall 1970 are based on data from 3,071 science doctorate departments of 227 universities and colleges that submitted traineeship applications to the National Science Foundation. Similarly, statistics showing the relative change in enrollment and other characteristics of graduate science education during 1969-70 are based on data reported by 2,740 doctorate departments that supplied information for both 1969 and 1970. The science doctorate departments covered in the present study accounted for more than three-fourths of the graduate enrollment and more than nine-tenths of the doctorates granted in the sciences and engineering by U.S. universities and colleges.

A more detailed examination of enrollment, faculty, and postdoctoral data will be made in the forthcoming report, *Graduate Student Support and Manpower Resources in Graduate Science Education, Fall 1970*, which will be available from the Government Printing Office.